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ABSTRACT

The guide is designed to provide a basis for effective communication between local education agencies and local advisory committees regarding industrial plastics eudcation and to communicate national and statewide program requirements so that local advisory committees may recommend program requirements that meet local needs with due concern for State and national needs. There is recent evidence that the plastics industry as a whole is less aerospace oriented and becoming more industrial plastics oriented. Hence it is recommended that a school planning a preparatory program carefully review its objectives with its local advisory committee. The document is organized by task analysis and course objectives for the three jobs of machine and hand parts finisher, plastic bench mechanic, and plaster and plastic tooling mechanic. For each vocation, occupational information steps to accomplish each task and what constitutes satisfactory performance are described. (Author/LJ)

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TASK ANALYSIS

for

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FOREWORD

Task Analysis for Industrial Plastics represents another step in the continuing efforts of the Coordinating Council for Occupational Education to exercise and promote leadership at every level of vocational education; to encourage and facilitate appropriate community involvement in the selection, design, production, and operation of effective quality vocational education programs.

The Advisory Committee's contribution of time and effort required to write this guide is an outstanding example of the industrial community's willingness to commit its talents and resources in cooperation with the Coordinating Council to achieve this end.

This guide is designed to provide a basis for effective communication between local education agencies and local advisory committees; to communicate national and statewide program requirements so that local advisory committees may recommend program requirements that meet local needs with due concern for state and national needs.

Arthur A. Binnie
State Director and Executive Office
Coordinating Council for Occupational Education

PREFACE

In 1970 a number of local schools were able to identify an increasing need for people to be trained to work in the plastics industry.

The Coordinating Council for Occupational Education selected a regional advisory committee from the Puget Sound area and employed Mr. Richard Evans to do an analysis of the occupations performed by workers in that industry.

Mr. Evans and the CCOE staff met with the committee and reviewed his job assignment and objective.

The committee reviewed Mr. Evans' work several times during the analysis and on completion validated the final document.

There is recent evidence that the plastics industry as a whole is less areospace oriented and becoming more industrial plastics oriented. Hence a school planning a preparatory program should carefully review their objectives with their local advisory committee.

Instructors developing a curriculum should make student personal and leadership development an integral part of the instructional program. The Coordinating Council for Occupational Education strongly recommends that goals for personal growth be partially accomplished through the Vocational Industrial Clubs of America (VICA) student group.

To secure additional copies of this document, to recommend changes, or to secure additional information, please direct inquiries to the CCOE, Program Development personnel listed below.

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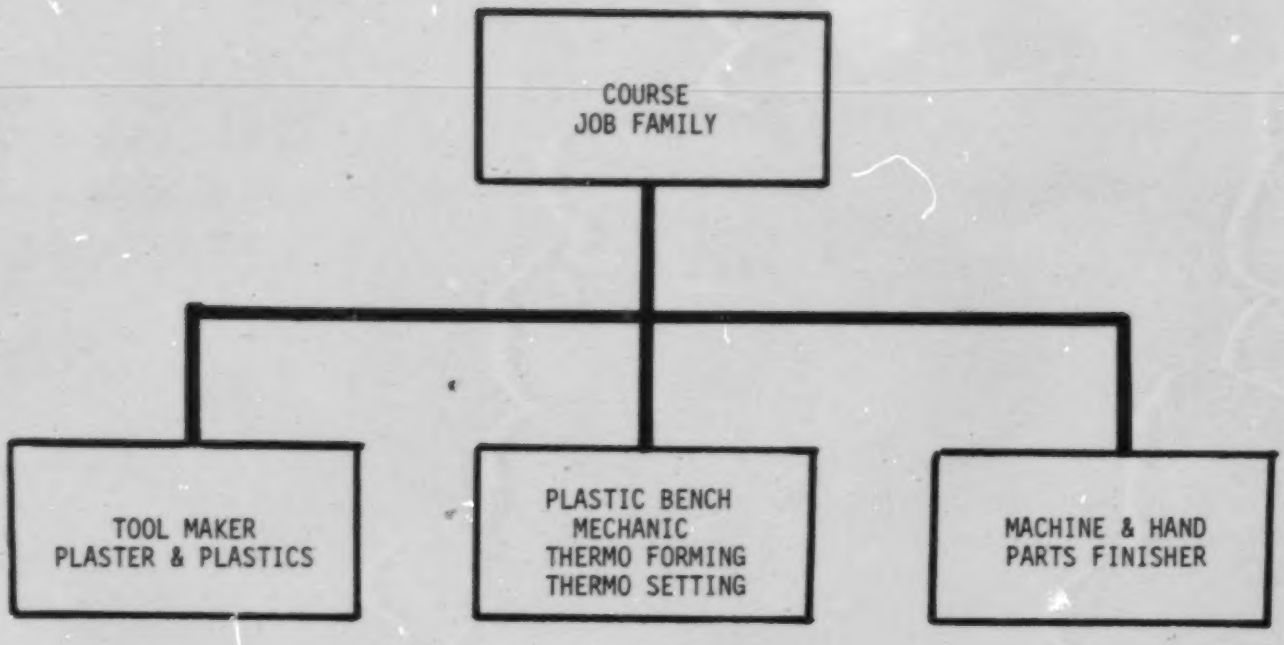

EXHIBITS:

A JOB DESCRIPTION

B TASK ANALYSIS

C COURSE OBJECTIVES

VOCATION: MACHINE AND HAND PARTS FINISHER

The Machine and Hand Parts Finisher is a semi-skilled mechanic who shapes thermo-forming and thermo-setting plastic parts by the use of power and hand tools. He is able to select, setup and adjust the appropriate tools for each job, and plan the finishing sequence of operations. He is able to interpret prints, charts, documents, tooling, and other written and verbal information. He is able to convert fractional values into decimal equivalents. The mechanic uses precision measuring tools necessary to accomplish his work assignments. His work includes hand and power tool finishing by sawing, routing, drilling, spotfacing, counterboring, reaming, tapping, and grinding under the direction of a lead employee. He will locate, check, and align parts into templates, jigs, and fixtures to accomplish the shaping and assembly of these parts.

VOCATION: PLASTIC BENCH MECHANIC

THERMO FORMING - THERMO SETTING

The Plastic Bench Mechanic possesses a great deal of manipulative skill in the fabrication of numerous plastic processes. He is a semi-skilled production worker; his skills involve the application of parting agents of all types (solution, paste, and film). He is skilled in the fabrication of structural and non-structural vacuum laminants. In addition to vacuum laminants, he is skilled in the fabrication of wet polyester lay-up through the use of a chopper gun or hand laminating process. His related knowledge covers the forming, potting, casting, and bonding of plastic details, and using processes and procedures that have been established. He will use and operate all hand and power tools in the performance of his work assignment. He must be able to obtain information required for fabrication from simple prints and sketches. The Plastic Bench Mechanic is skilled in the use of shop math including decimals, fractions, and figuring percentages. The job requires the mechanic to use spraying equipment for the application of polyester gel-coats. He must be able to follow directions as set forth by lead employees.

PLASTER AND PLASTIC TOOLING MECHANIC

The Plaster and Plastic Tooling Mechanic is a semi-skilled technician who assists journeymen tool makers in the fabrication of molds and patterns. He fabricates tooling aids from previously developed patterns. He reworks and repairs patterns and mockups when true views or projected measurements are given. He performs the basic rudiments of tooling such as mixing plaster, making wooden boxes for patterns, patching and pointing plaster. In the area of plastic tooling, the mechanic laminates detail plastic tools such as molds, fixtures, and trim templates. He rescribes existing lines on transfers from other tools. The Plaster and Plastic Tooling Mechanic is required to shear, drill, saw, rout, and file to predetermined dimensions. He must use shop math including decimals, fractions, percentages, and right angle trigonometry.

NO.	VOCATION: Machine and Hand Parts Finisher TASK	FREQUENCY OF PERFORMANCE	IMPORTANCE	LEARNING DIFFICULTY
1.	Using Small Hand Tools	Continuously	Must Know	Easy
2.	Solving Shop Math Problems	Often	Should Know	Difficult
3.	Reading Precision Measuring Tools			
4.	Performing Flat Pattern Layout	Seldom	Need to Know	Moderate
5.	Using Portable & Stationary Power Tools			
6.	Drill Reaming & Taping			
7.	Demonstrate the Care & Use of Files			
8.	Fabricate a Plaster Splash Cast			
9.	Laminate a Room Temperature Epoxy Tool			
10.	Laminate & Reinforce a Plastic Face Splash Cast			
11.	Sloush & Sweep a Plaster Mandrel			
12.	Rework Plastic Tools			
13.	Rework Plaster Mockups			
14.	Cast with Epoxy Resins			
15.	Maintain Safety & Housekeeping Standards			
16.	Visualize Object on Prints, Sketches, and Orthographic Drawing			
17.	Laminating a High Temp Plastic Mold			

NO.	VOCATION: Machine and Hand Parts Finisher TASK	FREQUENCY OF PERFORMANCE	IMPORTANCE	LEARNING DIFFICULTY
1.	Use Hand Tools	Continuously	Must Know	Difficult
2.	Solving Shop Math Problems	Often	Must Know	Moderate
3.	Reading Measuring Tools	Often	Must Know	Moderate
4.	Reading Orthographic Drawing			
5.	Identifying Cutting Tools			
6.	Demonstrate Power Tool Safety			
7.	Set up, Adjust, and Operate a Band Saw			
8.	Identify the type and functions of Production Tooling			
9.	Set up a Production Part in a Hand Router Tool and Rout Net Trim			
10.	Index a Production Part in a Shaper Fixture and Pin Rout			
11.	Drill, Spotface, Counterbore, and Ream Holes in Thermo Forming and Thermo Setting Plastic Parts			
12.	Assemble Finished Detail Parts Per Print			
13.	Following a Written Manufacturing Plan			

VOCATION: Machine and Hand Parts Finisher

TASK: No. 2 - Solving Shop Math Problems

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Solving Fractions	When the trainee is able to solve fractions through the use of addition, subtraction, multiplication, and division at an 80% satisfactory completion level.
2.	Solving decimals	When the trainee is able to solve decimals through the use of addition, subtraction, multiplication, and division at a 90% satisfactory completion level.
3.	Defining the area of a surface in square feet and inches	When the trainee is able to determine the amount of resin and reinforcing material to fabricate a laminant of a given thickness.
4.	Defining the volume of an object in cubic inches	When the trainee is able to calculate the amount of resin required to fill a given cavity and calculate the amount of styrofoam required to fill a mold with a variety of densities.
5.	Solving percentage problems	When the trainee is able to calculate the percentage of hardener to resin and percentage of glass cloth to resin on a one to one ratio.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 3 - Reading Measuring Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Read a scale	When the trainee is able to read a scale in tenths, hundredths, fiftieths, sixty-forths, thirty-seconds, sixteenths, and eighths within .010 of an inch.
2.	Read a micrometer	When the trainee is able to read a micrometer to the closest .0005 of an inch and demonstrate the proper care and handling methods for the instrument.
3.	Read a Vernier scale	When the trainee is able to read the scale on a Vernier height gauge and a Vernier calipher to the closest .001 of an inch, and demonstrate the proper care and use of these instruments.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 4 - Reading Orthographic Drawings

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Line identification	When the trainee is able to identify by name the ten basic types of lines used on an orthographic drawing.
2.	Drawing format	When the trainee is able to identify the six basic areas of a drawing and define the functions of each of these areas.
3.	Identify the basic types of drawings	When the trainee is able to define the functions of a detailed drawing, assembly drawing, installation drawing, and a tooling drawing.
4.	Identify drawing symbols	When the trainee is able to identify and define functions of the twenty drawing symbols most frequently used.
5.	Visualization of an object	When the trainee can draw the third view of an object when two views are given.
6.	Definition of reference planes	When the trainee can identify by name and function a datum plane, machine reference plane, water line, buttock line, and station line plane, and their functional relationships.
7.	Identify sectional views	When the trainee is able to define the means of rotation of a cutting plane and draw a sectional view to the proper perspective.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 5 - Identifying Cutting Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Hand Router Nomenclature	When the trainee is able to identify the proper router, busing, and cutters for the trimming of plastic and non-ferrous materials with respect to motor RPM's, air-line size, shank and cutter size, and setback requirements for guide bushings.
2.	Cutter selection	When the trainee is able to define the application of carbide cutters, diamond abrasive cutters, and conventional steel router bits.
3.	Pin router nomenclature	When the trainee is able to define the purpose and operating procedures required to set up and operate the pin router.
4.	Table shaper familiarization	When the trainee can identify the setup procedures and functional operations involved in operating the shaper with respect to cutter diameter, adjustable spindle, guide bushings, and machine limitations.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 6 - Demonstrate Power Tool Safety

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Safety requirements for operating a band saw	When the trainee is able to adjust the guides on a band saw with respect to material thickness and demonstrate the application of a guide and push stick, and define the proper eye protection for the material being cut.
2.	Operating a drill press	When the trainee can demonstrate the proper method for chucking drills, clamping of material, proper eye wear, and the proper application of cutting lubricants.
3.	Operating a disc sander	When the trainee can define the direction of rotation of the grinding wheel and show the proper method of applying the material to the downward rotation side of the wheel, and demonstrate the proper setup and operation by adjusting the gap between the table and the wheel, and utilizing the proper eye wear. NOTE: In the operation of all power equipment loose clothing such as neck ties, shirt sleeves, belts, etc., should be removed prior to the operation of any power equipment.
4.	Operation of routers, spindles, and shapers	When the trainee can demonstrate the safety precautions in operating power routers with respect to cutter height, rotational direction of a cutter, eye wear, and proper vacuuming of waste materials.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 7 - Setup, Adjust, and Operate a Band Saw

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Band saw blade selection and installation	When the trainee is able to select the proper blade for the material being cut and install it on the band saw with the proper tension.
2.	Marking rough saw trimlines	When the trainee is able to index the production part to a tool and cado mark rough trim lines 1/4 inch outside the periphery of the tool.
3.	Adjust guides and rough saw	When the trainee can adjust band saw guides with respect to material thickness and trim the part within .030 of the rough trim line without delamination of the part.
4.	Safety and housekeeping	When the trainee can demonstrate the proper safety precautions in the operation of a band saw and clean the saw and surrounding area in compliance with shop housekeeping standards.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 8 - Identify the Types and Functions of Production Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Define functions of a mold	When the trainee can describe the function of a mold and state its relationship to the mockup or plug, and define whether it is part applied or part contained.
2.	Define the use of trim tools	When the trainee can demonstrate how trim tools are indexed to the molded surface of production parts and define their functions with respect to trimming, indexing, and drilling of holes when required.
3.	State the function of an assembly tool and demonstrate its use	When the trainee can show how production parts are indexed, drilled, and assembled through coordination indexes on assembly jigs with the use of the tool and production parts.
4.	Identify and use of various types of drill jigs	When the trainee is able to demonstrate the application of a drill jig and index production parts for drilling.
5.	Identify and demonstrate the application of a marking template	When the trainee can define the purpose of a marking template and show the proper method of indexing to perform the marking operation.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 9 - Setting Up a Production Part in a Hand Router Tool and Rout Net Trim

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Rough trim part	When the part has been sawed to the rough trim line with the use of a band saw to a tolerance of ± .030 in accordance with shop safety standards.
2.	Index production part in the tool	When the production part has been nested on the tool and index holes have been drilled in the trim tabs and coordination pins installed to maintain indexing.
3.	Set up hand router for trimming	When the hand router being selected will produce a minimum of 2,000 RPM's and the guide bushing selected has a minimum bearing surface of 3/4 of an inch and the cutter diameter allows the proper setback with respect to the setback established on the tool.
4.	Rout net periphery	When the production part has been properly indexed to the trim tool and clamped in place, the net trim will be routed to within ± .010 of an inch of the setback on the tool. NOTE: All excess material being removed during the routing operation should be caught with the use of vacuum and a face shield should be worn over safety goggles during the use of high speed routers.
5.	Lightly sand net periphery and remove index tabs	When the index tabs have been removed from the production part in accordance with net trim requirements and the total periphery lightly sanded to remove all wicked fibers left from the routing operation.
6.	Finish part complete	When the machined edge has been sealed with a resin mix to eliminate any slight delaminations and part number has been rubber stamped on the detail part as prescribed by drawing requirements.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 10 - Index a Production Part in a Shaper Fixture and Shape Periphery

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Prepare part for routing	When the production part has been sawed to a rough trim line within ± .030 and cleaned up with all resin ridges removed for indexing in the shaper fixture.
2.	Set up table shaper	When a carbide cutter has been installed in the chuck at a height of 1/4 inch beyond the thickness of the tool and production part, and the guide bushing set to index to the total surface of the trimming edge of the tool.
3.	Index production part for routing	When the production part is nested in the trim tool and clamped in place with no clearance existing between the nesting surfaces of the tool and the production part greater than .010 of an inch. NOTE: Facility holes may be established in the tool to check nesting tolerances.
4.	Shape net trim	When production part and tool have been positioned on the operating side of the shaper and the net trim shaped to a tolerance o ± .010 of an inch of the shaping tools periphery. NOTE: A vacuum line may be clamped approximately six inches from the cutter on the non-operating side of the shaper and a face shield must be worn over safety goggles in all shaping operations.
5.	Finish part complete	When all machine edges have been sanded and sealed to eliminate any wicking or minor delaminations, and the part has been identified in accordance with drawing requirements.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 11 - Drilling, Spotfacing, Counter Boring, and Reaming Holes in Thermo Forming and Thermo Setting Plastic Parts

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Selection of tools	When the trainee has selected the proper drill motor, drill size, counter bore and pilot, spotfacer and pilot, and piloted reamers to machine the part per drawing requirements.
2.	Drill all holes complete	When the trainee has indexed the plastic part to the drill jig and drilled all hole sizes in accordance with the color code identified on the drill jig. NOTE: All holes should be backed up to eliminate fracturing or delamination of the part.
3.	Remove the production part from the tool and spotface and counter bore complete	When the required holes have been spotfaced and counter bored with the bearing surface perpendicular with the center line of the hole to an angular tolerance of one degree and the diameter of the bearing surfaces concentric with the hole to a tolerance of $\pm$ of .010 of an inch.
4.	Reaming holes to size	When the piloted holes for spotfacing and counter boring have been reamed to drawing requirements to a tolerance of $\pm$ .001 of an inch without delaminating the holes.
5.	Seal machined edges	When all holes and bearing surfaces have been sealed with the resin mix prescribed by the drawing to eliminate delaminations or fractures around the periphery of the holes.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 12 - Assemble finished Detail Parts Per Print

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Load assembly tool	When the detailed parts have been located in the assembly jig to the index stops to a tolerance of ± .010 of an inch with sufficient clamping pressure to eliminate movement during the drilling operation.
2.	Drill pilot holes full size	When all pilot holes have been back drilled to the size specified on the drawing.
3.	Disassemble and prepare for bonding	When the detail parts have been removed from the assembly jig and all holes burred and the gloss removed from the faying surface without sanding through the glass fabric.
4.	Load assembly jig and bond	When a light even coat of adhesive has been applied to the faying surface and the detail parts bonded in the assembly jig located with cleco clamps through the full size holes with a maximum clamping pressure of ten pounds per square inch, and all excess adhesive removed with the use of cheesecloth moistened in MEK. NOTE: Location of all detail parts should be checked for location with respect to the indexes with the use of a .020 feeler gauge.
5.	Removal of bonded assembly after cure	When the assembled parts have been allowed to cure at room temperature for twelve hours and the cleco clamps removed and a drill run through the holes to remove any excess adhesive.
6.	Install fasteners	When fasteners have been installed in all holes per drawing requirements.

VOCATION: Machine and Hand Parts Finisher

TASK: No. 13 - Following a Written Manufacturing Plan

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Identifying and defining the areas on a manufacturing record	When the trainee can define and identify the functions of the following codes on an MR: (a) part number (b) priority code (c) completion schedule (d) part name (e) product effective number (f) storage number (g) next used on number (h) tool work order code (i) quantity required (j) material specification (k) tool schedule and reason (l) production sequence (m) manufacturing operations (n) drawing zone and sheet (o) drawing change notice/advance drawing change notice
2.	Relating the manufacturing plan to the drawing and production tools	When the trainee can state the relationship of manufacturing plan to the drawing and production tool by relating material requirement, proper manufacturing sequence, location of detail on engineering drawing, and quality standards.

COURSE OBJECTIVES

VOCATION: Machine and Hand Parts Finisher

NUMBER	
Task #5	When the trainee is able to identify the appropriate cutter and cutting speed for thermo forming and thermo setting plastics by correctly answering 8 of 10 questions on M&HPF E-1.
Task #5	When given a router, production part, bushing, and router tool, the trainee will demonstrate his knowledge of cutter selection by selecting a cutter with respect to set back requirement and length. Measured by demonstration.
Task #5	When given the material to be shaped and the shaping tools, the trainee must demonstrate the safety rules related to manufacturing operations involved. Measured by demonstration.
Task #6	When given the safety precautions related to the operation of a band saw, the trainee will demonstrate these safety rules in setting up the band saw. Measured by demonstration. No errors allowed.
Task #6	When given a drill press, drill, chuck key, clamps, and stock, the trainee will demonstrate the safety rules related to the operation of a drill press. Measured by demonstration. No errors allowed.
Task #6	When given a disc sander, the trainee will demonstrate proper setup procedure related to safe operation of the sander. Measured by demonstration. No errors allowed.
Task #6	When given a power router, the trainee will define the safety performance standards relative to setting up and operating a router. Measured by demonstration. No errors allowed.
Task #6	When given the safety performance standards for a band saw, drill press, disc sander, and router, the trainee will demonstrate his knowledge of safety standards by correctly answering 18 of 20 questions on exercise M&HPF -6.
Task #7	When given a plastic part, trim tool, cado marker, band saw, and blades, the trainee will demonstrate his ability to set up and operate a band saw by trimming a plastic part within .030 of a rough trim line without major delaminations. Measured by work project M&HPF -7.

COURSE OBJECTIVES

VOCATION: Machine and Hand Parts Finisher

NUMBER	
Task #8	When given a mold, trim tool, assembly jig, drill jig, and marking template, the trainee must demonstrate his knowledge by defining the purpose of each tool and the functional relationship of the family of tools by correctly answering 8 of 10 questions on M&HPF exercise -8.
Task #8	When given a plastic part and a trim tool, the trainee must demonstrate his knowledge by indexing the part to the tool with the use of coordination holes to a tolerance of ± .010 of an inch. Measured by demonstration.
Task #8	When given an assembly jig, detailed production parts, production planning, and a drawing, the trainee will demonstrate his knowledge by indexing production parts in accordance with the planning sheets and justify their location with the assembly drawing. Measured by demonstration.
Task #9	When given a router, abrasive cutter, bushing, production tool, production part, and compressed air, the trainee will demonstrate his ability to trim production parts by routing the net periphery of the part to a tolerance of ± .020.
Task #9	When given a trimmed production part, resin mix, solvent, and sandpaper, the trainee will demonstrate his ability to seal all machined edges and eliminate any minor delaminations. Measured by demonstration.
Task #10	When given a table shaper, shaper fixture, carbide cutter, and guide bushing, the trainee will demonstrate his ability to shape the net periphery of production part to drawing tolerance.
Task #10	When given a trim production part, manufacturing paperwork, engineering drawing, rubber stamp, and pad, the trainee will identify the part as specified on the manufacturing plan in the location stated on the drawing. No errors will be allowed.
Task #11	When given a list of thermo forming and thermo setting plastic materials, the trainee must demonstrate his knowledge by identifying proper abrasive cutters and cutting speeds by correctly answering 8 of 10 questions on M&HPF -11.

COURSE OBJECTIVES

VOCATION: Machine and Hand Parts Finisher

NUMBER	
Task #11	When given a drill motor, drills, spotfacers, counter bores, reamers, plastic parts, and compressed air, the trainee will demonstrate his knowledge of machining thermo forming and thermo setting plastic parts by completing the work as specified on the manufacturing plan without fracturing or delaminating the holes or bearing surfaces. Measured by work project M&HPF -11.
Task #12	When given a manufacturing plan, drawing and assembly tool, the trainee must demonstrate the appropriate manufacturing sequence by relating the steps on the manufacturing plan to the engineering drawing. Measured by demonstration.
Task #12	When given detail parts, assembly jig, manufacturing plan, engineering drawing, adhesive, and fasteners, the trainee will demonstrate his knowledge of assembly work by completing the assembly to a drawing tolerance of $\pm$ .030 of an inch. Measured by work project M&HPF -12.
Task #13	When the trainee is able to define the functions of all operations as specified on a manufacturing plan by correctly answering 15 of 20 questions on exercise M&HPF -13.
Task #13	When the trainee is able to state the purpose for 15 to 20 master record designators and identify their location on the master record.
Task #13	When the trainee can define the functional relationship of engineering planning, tool design, tooling and production by answering 8 of 10 questions on exercise M&HPF -13-2.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting and Machine and Hand Parts Finisher

TASK: No. 1 - Use of Small Hand Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Identify and use hand tools	When given the following list of hand tools, identify each tool with its correct name and demonstrate the safety requirements for each specific tool: 10 ounce ball peen hammer Sharpening stone Utility knife 6" pliers 6" flex scale 8" scissors 12" scissors Slotted screwdriver 12" combination square 6' steel tape 8" crescent wrench 1/4" socket and ratchet set 1" micrometer 3 and 6" dividers

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 2 - Solving Shop Math Problems

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Solving fractions	When the trainee is able to solve fractions through the use of addition, subtraction, multiplication, and division at an 80% satisfactory completion level.
2.	Solving decimals	When the trainee is able to solve decimals through the use of addition, subtraction, multiplication, and division at a 90% satisfactory completion level.
3.	Defining the area of a surface in square feet and inches	When the trainee is able to determine the amount of resin and reinforcing material to fabricate a laminant of a given thickness.
4.	Defining the volume of an object in cubic inches	When the trainee is able to calculate the amount of resin required to fill a given cavity and calculate the amount of styrofoam required to fill a mold with a variety of densities.
5.	Solving percentage problems	When the trainee is able to calculate the percentage of hardener to resin and percentage of glass cloth to resin on a one to one ratio.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 3 - Reading Measuring Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Read a scale	When the trainee is able to read a scale in tenths, hundredths, fiftieths, sixty-fourths, thirty-seconds, sixteenths, and eighths within .010 of an inch.
2.	Read a micrometer	When the trainee is able to read a micrometer to the closest .0005 of an inch and demonstrate the proper care and handling methods for the instrument.

VOCATION: Plastic Bench Mechanic Thermo Forming and Thermo Setting

TASK: No. 4 - Fabrication of a Structural Fiberglass Laminant

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Clean the working area of contaminates	When the surface where the preimpregnated material will be cut and laminated is completely free of oil, grease, or any other foreign matter such as dust and dirt.
2.	Cut preimpregnated plies	When each ply of prepreg is cut to a pattern with manufacturing excess with the backing film intact and when protective measures are taken to prevent hand contamination of the plies.
3.	Apply parting agent	When a ply of nylon, PVA (Poly Vinyl Alcohol) PVF (Poly Vinyl Floride), or mylar is applied to the surface of the tool without bridging or wrinkling and securely taped in place; or when a PVA solution is sprayed on the surface of the tool without runs to a maximum of a three mill density.
4.	Precut core material	When the core is spliced without collapsing, distorting or depressing cell walls and is free of contaminants and shaped to drawing requirements.
5.	Laminate outer skin	When the outer skin plies have been applied to the mold without wrinkling or bridging with splices and laps no less than 1/2 inch or no greater than one inch.
6.	Cado mark doubler ply locations	When the marking template has been indexed to the tool and the staggered doubler locations are marked through the marking holes on the template.
7.	Apply doubler plies	When the outer doubler plies have been indexed to the laminant free of wrinkles and bridging to the locations as marked by the marking template.
8.	Apply core	When the core material is located on the laminant per the marking template within a tolerance of 1/8 of one inch.
9.	Apply filler plies	When sufficient filler plies have been added to give the edgeband the desired thickness and staggered 1/4, 3/8, and 1/2 inches wide next to the core to prevent depressions.
10.	Apply inner doubler	When the first layer of the inner doubler is extended 1/2 inch or the core material and each succeeding ply is staggered 1/2 inch beyond the previous ply with all plies being free of wrinkles and bridging.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 4 - Fabrication of a Structural Fiberglass Laminant

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
11.	Layup inner skin	When the inner skin plies are applied without wrinkles or bridging and with the lap joints not exceeding 1 inch or less than 1/2 inch.
12.	Apply bondable tedlar	When the tedlar has been worked down over the entire inner skin surface and all wrinkles and air pockets have been removed.
13.	Apply edge bleeders	When the edge bleeder is placed around the entire periphery of the layup and comes in contact with the edge of the layup but must be 1/2 inch outside the net periphery of the finished part.
14.	Apply vacuum	When extruded sealing compound has been applied around the total periphery of the laminant and bleeder; the vacuum line attached; and a diaphragm nylon film has been applied to the sealing compound with 20 inches of mercury slowly applied to the interior of the diaphragm.
15.	Squeegee operation	When all surfaces of the laminant have been worked with a squeegee to prevent gapping or bridging between the part and the bleeder and bridging of the prepreg around the periphery of the honeycomb core.
16.	Cure	When the layup has been placed in an autoclave and 45 PSI applied to the tool and laminant and the autoclave temperature brought up to 260° for 90 minutes in compliance with the manufacturing heatup procedure.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 5 - Fabricating Non-Structural Preimpregnated Polyester Laminants

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Clean work area of all contaminates	When the cloth table and work area have been cleaned to insure removal of grease, oil, and dirt.
2.	Prepare mandrel or mold for parting agent	When the surface of the tool is free of all irregularities and clean to insure against contamination.
3.	Apply parting agent	(Plastic Tools) When two or three thin coats of Simoniz paste wax have been buffed on the surface of tool to a glossy finish with two or more applications of PVA parting solution applied very lightly to avoid runs or excess buildup. (Plaster Mandrels) When the mandrel has had two or more coats of parting lacquer applied with two or more applications of PVA solution. NOTE: Approximately 30 minutes of drying time is required between applications of PVA solution.
4.	Precut prepreg material	When the required number of plies have been cut to a predetermined pattern and wrapped in a vinyl film to avoid contamination.
5.	Layup	When the precut prepreg has been placed on mold with minimum amount of wrinkles and bridging, each succeeding layer worked down tightly to conform to the surface of tool with the seams staggered to prevent excessive buildup. No lap width shall exceed 1 inch.
6.	Apply bleeders	When a periphery bleeder has been applied to the total edge of laminate and connected to a vacuum line.
7.	Vacuum bag application	When the laminate is vacuum bagged with a minimum pressure of 20 inches of mercury without bridging or excessive wrinkles.
8.	Laminate cure	When the temperature of the cure cycle is contolled by thermo couples to the prescribed cure method and heat range.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 6 - Compression Molding of Nonstructural Mat Molded Parts

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of mold surface	When the mold surfaces have been cleaned of all foreign matter and all surface irregularities removed.
2.	Application of parting agent	When two coats of CD Mold Release or paste wax have been applied to the surface of the mold without excessive buildup or bare spots.
3.	Calculating the amount of resin and catalyst required	When the amount of the catalyst and resin equals the weight of the glass reinforcing mat required for fabrication of the part.
4.	Bake the match molds	When the match molds have been baked for one hour at 300° F and all excess mold release has been wiped off with clean cotton cloth.
5.	Cutting of glass reinforcing mat	When the glass reinforcing material has been cut to a pattern allowing manufacturing excess without soiling or contamination.
6.	Mix and apply resin	When the proper ratio of catalyst to resin has been weighed and thoroughly mixed and applied to the preformed glass mat in the female cavity of the mold.
7.	Apply pressure	When the male and female halves of the mold are closed slowly to prevent wrinkling and allowed sufficient flow time to thoroughly saturate the mat until the match molds index to the stop blocks.
8.	Cure of mat mold part	When the part has been allowed to cure at room temperature for sufficient time to insure proper parting. NOTE: Cure time can be shortened by applying heat.
9.	Removal of part	When the matching molds have been separated and the part removed with air pressure and phenolic wedges without damage to the part or mold.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 7 - Processing of Acrylics

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Clean and prepare vacuum tool	When the surface of the tool is clean of all foreign matter and high temp vacuum tape is applied to the extemity of the tool surface and vacuum outlets connected and checked for leakage.
2.	Preparation of material	When the protective masking of material has been removed and the sheet washed with warm soapy water and a clean soft cloth.
3.	Heating of material	When the part is allowed to reach a temperature of 275 to 360° for 60 to 120 seconds and removed and applied directly to the mold and a minimum of 20 inches of mercury drawn and the part is allowed to cool slowly on the mold to room temperature.
4.	Removal of acrylic part from mold	When the part has been allowed to reach room temperature without chilling drafts and removed from the mold and cleaned per step #2 and masking material reinstalled.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 8 - Processing of Thermo Plastic Sheets

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Prepare vacuum forming mold	When the surface of the mold has been cleaned of all foreign matter and a light coat of industrial talc has been applied for lubrication of the mold.
2.	Clean sheet material	When the sheet material has been wiped clean with naphtha stored in a safety can with the use of any clean oil-free absorbent material.
3.	Attach sheet material to vacuum-forming ring	When the thermo forming sheet has been attached to the vacuum ring with the use of staples or clamps to insure stability when heating.
4.	Establish heat range and duration	When a minimum of three heat sensing devices have been placed on both sides of the material while attached to the vacuum ring. Record the time to bring the material to a temperature of 300° F.
5.	Heat and vacuum form	When the material has reached the predetermined temperature the decorative surface will be applied to mold as identified on the tool. The time to complete this operation shall not exceed 10 seconds from the time the material is removed from the heat source until the vacuum is drawn.
6.	Remove part from mold	When the part is cooled under vacuum with compressed air until the part reaches room temperature. NOTE: A ram may be used to facilitate forming operations.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 9 - Hand Laminating with Wet Polyester Resins

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Clean the mold	When the mold is free of all contaminants such as grease, dust, dirt, and ready for the application of parting agents.
2.	Apply parting agent	When the mold has received a buffed coat of CD Mold Release or equivalent and three applications of PVA solution sprayed on the entire surface of the mold without runs or orange peel.
3.	Calculate the square surface of the mold	When the trainee is able to calculate the number of square feet on the mold surface to the closest square foot.
4.	Weigh gel-coat	When the amount of gel-coat is 30 times greater than the number of square feet on the mold surface with the proper ratio of resin to catalyst.
5.	Mixing and applying gel-coat	When the proper ratio of resin and hardener has been mixed sufficiently without whipping in excess air. The mixture is then applied to the mold with the use of a spray gun and pressure pot to a consistent thickness of approximately 1/64 of an inch.
6.	Inspection of the gel-coat	When the trainee is able to define tack free state and identify any non-consistent areas such as bare spots and excessive buildup.
7.	Weigh laminating resin	When the weight of the resin and catalyst per ply equals the weight of the reinforcement material or when the weight of the resin and catalyst equals 27 times the surface of the mold in square feet with the proper ratio of resin to catalyst.
8.	Apply laminating resin and glass reinforcement	When the trainee is able to apply the proper amount of laminating resin per square foot to sufficiently wet the reinforcing material and demonstrate his skill of hand laminating by working up all excess air and resin to insure a void free gel-coat.
9.	Room temperature cure of first stage	When the first layer of reinforcing material and resin has been allowed to cure at room temperature without any bridging of reinforcing material during cure.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 9 - Hand Laminating with Wet Polyester Resins

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
10.	Laminate complete	When the trainee can apply the remaining layers of roaving and mat by the same process of working the resin and entrapped air through the weave or strands of reinforcing material with the proper ratio of resin to glass reinforcement.
11.	Cure and removal of laminant	When the laminant is allowed to cure for 24 hours at room temperature and removed from the mold without damage or distortion to the mold or the laminant.
12.	Housekeeping	When the work area and mold have been cleaned in compliance with shop housekeeping procedures.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 10 - Operating a Chopper Gun

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Adjustment of gun	When the chopper gun has been adjusted until the reinforcing fiber output is equal by weight to the resin mixture output.
2.	Injection of reinforcing fibers into resin system	When the chopped strands enter the resin stream one-inch in front of the gun nozzle with a minimum air pressure of 50 pounds per square inch.
3.	Spray up	When the chopped reinforcing material and spray resin are applied simultaneously at a distance of 40 inches from the mold surface and each pass is overlapped slightly to insure consistent thickness.
4.	Rolling of the laminate	When the entire surface of the sprayed laminate is compressed with the use of a disc harrowed roller to insure compression and to eliminate porosity.
5.	Application of glass cloth	When a layer of glass cloth or roaving has been applied over the entire chopped laminate and all excess resin worked into the layer of glass cloth. NOTE: If any dry spots remain in the woaven fabric squeegee on additional resin.
6.	Clean up spray equipment	When all of the components of the chopper equipment that has been exposed to the resin system has been thoroughly flushed to insure against plugging and buildup of resin.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 11 - Spraying Polyester Gel-Coat

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Mold preparation	When the surface of the mold is completely free of all surface irregularities and a light coat of paste wax is thoroughly applied to the mold surface and buffed to a high gloss finish.
2.	Applying polyvinyl alcohol	When three coats of PVA have been sprayed on the mold surface without orange peel or runs to an approximate thickness of three mills.
3.	Calculate the amount of gel-coat required	When the amount of gel-coat is equal to 30 times the square footage of the mold.
4.	Mix and apply gel-coat	When the proper ratio of resin to catalyst has been thoroughly mixed and placed in a container in the pressure pot and sprayed on under a minimum pressure of 60 PSI at a distance from the mold of approximately three feet to a thickness of 1/32 of an inch. NOTE: The application of the gel-coat should start at the inner most surface of the mold and worked outward in a one direction spray with a slight overlap to eliminate gaps or bare spots. In addition, care should be taken to eliminate excessive buildup which will cause pulling of the gel-coat.
5.	Cure of the gel-coat	When the gel-coat has been allowed to set at room temperature until completely tack free to the touch.
6.	Application of backing material	When the backing material has been worked into a coat of resin applied to the gel-coat and all excess air and resin worked through the reinforcing material. NOTE: An acceptable gel-coat is a product of the first layer of reinforcing material. Care should be taken to insure the elimination of any briding or air bubbles during the laminating process.
7.	Cleaning of spray equipment	When solvent has been flushed through the spray gun immediately after the application of each container of gel-coat.
8.	Safety and housekeeping	When all safety precautions have been followed in the handling of solvents and resins and all housekeeping standards have been maintained.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 12 - Applying Parting Agents

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Applying paste wax to plastic tools	When the surface of the mold is cleaned with M.E.K. and two coats of wax are applied to the tool and buffed to a high gloss finish. NOTE: Sufficient drying time should be allowed between applications of paste wax.
2.	Applying parting agent on plaster and wood surfaces	(A) When the surface form has received a coat of sealer-release agent with a waiting period of two to five minutes for penetration and all excess removed with a clean cloth. (B) When two coats of clear lacquer have been applied and each coat has been allowed to dry for approximately fifteen minutes. (C) When a light coat of paste wax has been applied and lightly buffed.
3.	Applying parting agent to metal molds	When the surface of the mold has been cleaned with a clean cloth moistened in M.E.K. and two coats of paste wax have been applied and buffed to a high gloss finish.
4.	Spraying of parting agents	When the surface of the mold has been cleaned with M.E.K. to eliminate contaminates, the spraying of the parting agent should start at the closest point to the operator and progress away from him to prevent overspray. NOTE: A coat of approximately three mills should be applied without runs or bare spots.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 13 - Adhesive Bonding

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of faying surface	When the surface to be bonded has been cleaned with Methyl Ethel Ketone with a clean lint free cloth to remove all oil, grease, wax, or any other foreign matter.
2.	Surface preparation	When the surface of thermo setting plastics have been lightly sanded to remove the gloss from the molded surface in the bonded area only. NOTE: Caution should be taken to insure against sanding through the plies of the glass cloth.
3.	Preparation of adhesive	When the proper ratio of the adhesives component parts are thoroughly blended in a clean wax-free container without whipping in excess air.
4.	Apply adhesive	When a thin application of adhesive has been applied to each of the faying surfaces and the parts assembled with a firm uniform clamping pressure to insure complete contact of the faying surfaces.
5.	Removal of excess adhesive	When all excess adhesive has been removed prior to cure with the use of clean lint free cloth moistened in MEK.
6.	Cure	When the adhesive has been cured for 12 hours at room temperature with a maximum contact pressure of 10 PSI.

VOCATION: Plastic Bench Mechanic - Thermo Forming and Thermo Setting

TASK: No. 14 - Visualization of Prints and Sketches

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Line identification	When the trainee is able to identify by name the ten basic types of lines used on an orthographic drawing.
2.	Drawing format	When the trainee is able to identify the six basic areas of a drawing and define the functions of each of these areas.
3.	Identify the basic types of drawings	When the trainee is able to define the functions of a detailed drawing, assembly drawing, installation drawing, and a tooling drawing.
4.	Identify drawing symbols	When the trainee is able to identify and define functions of the twenty drawing symbols most frequently used.
5.	Visualization of an object	When the trainee can draw the third view of an object when two views are given.
6.	Definition of reference planes	When the trainee can identify by name and function a datum plane, machine reference plane, water line, buttock line, and station line plane, and their functional relationships.
7.	Identify sectional views	When the trainee is able to define the means of rotation of a cutting plane and draw a sectional view to the proper perspective.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic
Plaster and Plastic Tooling Mechanic
Machine and Hand Parts Finisher

*Plaster and Plastic Tooling Mechanic Only

NUMBER	
Task #2	When given decimal problem, he must demonstrate his knowledge by converting the decimal to fractions and the converse by correctly answering 25 of 30 questions on exercise Math-E-2.
Task #2	When given shop problems involving the addition, subtraction, multiplication, and division of fractions, he must demonstrate his ability to solve the problems by correctly answering 18 of 20 questions on Math-E-3.
Task #2	When given shop problems involving the addition, subtraction, multiplication, and division of decimals, he must demonstrate his ability by correctly answering 19 of 20 questions on Math-E-4.
Task #2	When given a resin and hardener percentage chart, the trainee must demonstrate the ability to calculate the proper ratio per mixture by correctly answering 35 of 40 questions on exercise RCC-1.
Task #2*	When given the dimension of a cavity, the trainee must demonstrate his knowledge by calculating the volume to the closest cubic inch. Measured by work project P&PTM E-2.
Task #2*	When given a trigonometry table, the trainee must demonstrate his knowledge of trigonometry by constructing and solving right triangle problems by correctly answering 15 of 20 questions, P&PTM E-2.
Task #3	When given a scale, demonstrate his ability to make correct readings within ± .010 by correctly answering 8 of 10 questions on exercise 3-1.
Task #3	When given a micrometer, demonstrate his ability to make correct readings within ± .0005 by correctly reading 10 of 15 micrometry block.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic
Machine & Hand Parts Finisher
Plastic & Plaster Tooling Mechanic
*Plaster & Plastic Tooling Mechanic Only

NUMBER	
Task #3	When he is able to demonstrate the proper care and handling methods for the micrometer to the satisfaction of the instructor.
Task #3*	When given a Vernier height gauge and calipher, the trainee must demonstrate the proper care and use of these instruments by correctly gauging 9 of 10 measurements on gauge blocks.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic

NUMBER	
Task #1	When given a complete list of hand tools required by a plastic bench mechanic, the trainee must demonstrate his knowledge of these tools by correctly identifying each tool and stating the related safety requirement for each specified tool.
Task #6	When given a production part and material requirement, the trainee must demonstrate his knowledge of compression molding by defining the fabrication process. No errors will be allowed.
Task #6	When given matched molds, glass mat and resin mixture, the trainee will demonstrate his knowledge of compression molding by fabricating a part without wrinkles or resin rich area. Measured by work project PBM 6-1.
Task #6	When given glass prepreg, matched molds and hot air gun, the trainee must demonstrate his ability to fabricate a laminated compression molded part by fabricating a part without wrinkles, voids, or resin starved area. Measured by work project PBM 6-2.
Task #7	When the trainee can demonstrate and define the fabrication process for acrylics with the use of related training aids. (No errors allowed.) Measured by demonstration.
Task #7	When the trainee can define the proper heat range and heat up time for acrylics materials from .050 to .250 in thickness by correctly answering 8 of 10 questions on exercise E-1.
Task #7	When given acrylic sheet, vacuum ring mold, vaccum tape and vacuum outlet, the trainee must demonstrate his ability to fabricate an acrylic part by making a part free of surface blemishes with the part conforming to the mold configuration within .030 of an inch.
Task #8	When given the related training aids required to process thermo plastic sheets, the trainee must define the manufacturing operations by correctly answering 8 of 10 questions on exercise PBM-8.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic

NUMBER	
Task #4	When given a layup mold and P.V.A. (Polyvinyl Alcohol Film), prepare the mold free of wrinkles, voids, and contaminates, measured by work project PBM-4.
Task #4	When given the appropriate prepreg, accomplish layup including cutting of cloth, with no wrinkles, or bridging allowed, measured by work project PBM-4.
Task #4	When given bleeder cloth, tedlar, vacuum fitting, extruded tape and PVA film accomplish bagging of layup, measured by work project PBM-4.
Task #4 & #5	When given a production laminated part describe the basic fabrication concepts for glass fabric reinforced plastic parts, measured by process for PBM-4 and 5.
Task #4 & #5	When given a copy of the Process Control Record describe the P.C.R. flow (PCR flow for work project PBM-4 and 5).
Task #4 & #5	When given training aid depicting the fabrication processes, correctly identify the aids to the given processes. (Material for work project PBM-4 and 5.)
Task #4 & #5	When given the job description for PBM, describe the elements of quality and quantity along with associated duties.
Task #4 & #5	When given the process for fabricating non-structural and structural laminates, construct a list of materials that become a part of the laminant. (No errors will be allowed.)

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic

NUMBER	
Task #9	When given gel-coat mixture, mold, parting agent, spray gun, and pressure pot, the trainee must domonstrate his ability to apply the gel-coat to a consistent thickness of approximately 1/64 of an inch without voids. Measured by work project PBM-9.
Task #9	When given a manufacturing flow cycle for fabricating wet polyester laminates, the trainee must define the performance standards for each set by correctly listing fifteen (15) of twenty (20) sets on exercise PBM-9.
Task #9	When given a list of toxic plastic materials, the trainee must demonstrate his knowledge of safety by defining the handle precaution required when working with these materials. Measured by demonstration.
Task #9	When given a gel-coated mold, laminating resin mixture, glass cloth, rubber gloves, and applicator, the trainee must demonstrate his ability to fabricate a polyester laminant free of voids with a one to one ratio of resin to glass cloth. Measured by work project PBM-9.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic

NUMBER	
Task #10	When given a chopper gun, resin mix and glass strands, the trainee must demonstrate his ability to set up the gun for operation by adjusting the gun nozzle where a one to one ratio of chopped strands enter the resin one inch in front of the gun nozzle. Measured by demonstration.
Task #10	When given a manufacturing flow cycle for chopped laminates, the trainee must demonstrate his knowledge by defining the performance standards for each operation by correctly answering 8 of 10 questions on exercise PBM -10.
Task #10	When given a chopper gun, resin mixture, glass strands, mold, glass roaving, and a harrowed disc roller, the trainee must demonstrate his ability to construct a chopped laminate by spraying up a 1/4 inch laminate consistence in thickness and free of entrapped air. Measured by work project PBM -10.
Task #11	When the trainee can define the safety precautions related to ventilation and the fire dangers related to cleaning solvents by correctly answering questions in an oral quiz.
Task #11	When given a spray gun, pressure pot, mold, resin mix, and air source, the trainee must demonstrate his ability to apply gel-coat by spraying on an even layer approximately .030 in thickness without void or air bubbles. Measured by work project PBM -9.
Task #13	When given bonding adhesives and cleaning solvents, the trainee must demonstrate his knowledge of safety and handling methods related to these materials by correctly answering 8 of 10 questions on exercise PBM E-13.
Task #13	When the trainee can prepare the faying surface for bonding without sanding through the glass reinforcement material and restrict the sanding to the bond area. Measured by demonstration.
Task #13	When given the step involved in the bonding process, the trainee must define the performance standards for each step. No errors allowed.
Task #13	When given plastic detail, solvent, sandpaper, clamps, and adhesive, the trainee will demonstrate his ability to bond plastic parts by bonding the details to drawing requirement with maximum contact pressure of 10 PSI. Measured by work project PBM 13-1.

COURSE OBJECTIVES

VOCATION: Plastic Bench Mechanic

NUMBER	
Task #12	When given molds made of plaster, wood, metal, or plastic, the student will demonstrate his knowledge of parting agent by defining the proper process for each surface. No errors will be allowed. Measured by demonstration.
Task #12	When given liquid parting agent, spray gun, compressed air and mold surfaces of various materials, the trainee will demonstrate his ability by spraying parting agents without runs or buildup to a maximum thickness of three mills. Measured by demonstration.
Task #12	When the trainee is given paste wax, molds made of plastic or metal and clean cheesecloth, he will demonstrate the application of paste wax by applying two coats of wax to the mold surface and buffed to a high gloss shine. Measured by demonstration.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 1 - Use of Small Hand Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Identify and use hand tools	When given the following list of hand tools, identify each tool with its correct name and demonstrate the safety requirements for each specific tool: Wood chisel Claw hammer Diagonal pliers Slip joint pliers 6" scale 8" scissors 8" slot screwdriver 6' flex steel tape 10" crescent wrench Scriber 10 ounce ball peen hammer 12" combination square Center punch 1" micrometer 3 & 6" dividers

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 2 - Solving Shop Math Problems

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Solving fractions	When the trainee is able to solve fractions through the use of addition, subtraction, multiplication and division at an 80% satisfactory completion level.
2.	Solving decimals	When the trainee is able to solve decimals through the use of addition, subtraction, multiplication and division at a 90% satisfactory completion level.
3.	Defining the area of a surface in square feet and inches	When the trainee is able to determine the amount of resin and reinforcing material to fabricate a laminant of a given thickness.
4.	Defining the volume of an object in cubic inches	When the trainee is able to calculate the amount of resin required to fill a given cavity and calculate the amount of styrofoam required to fill a mold with a variety of densities.
5.	Solving percentage problems	When the trainee is able to calculate the percentage of hardener to resin and percentage of glass cloth to resin on a one to one ratio.
6.	Solution of right triangles	When the trainee is able to solve a right triangle with two given sides, a given side and angle or by the use of square root.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 3 - Reading Precision Measuring Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Read a scale	When the trainee is able to read a scale in tenths, hundredths, fiftieths, sixty-fourths, thirty-seconds, sixteenths and eighths within .010 of an inch.
2.	Read a micrometer	When the trainee is able to read a micrometer to the closest .0005 of an inch and demonstrate the proper care and handling methods for the instrument.
3.	Read a Vernier scale	When he is able to read the scale on a Vernier height gauge and a Vernier calipher to the closest .001 of an inch, and demonstrate the proper care and use of these instruments.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 4 - Performing Flat Pattern Layout

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Erect a perpendicular to a line	When the trainee is able to erect a perpendicular on sheet metal with the use of dividers to an angular tolerance of 1/4 of one degree with line widths not to exceed .004 of an inch.
2.	Bisect an angle	When the trainee is able to bisect an angle on sheet metal with the use of dividers to a tolerance of ± .010 of an inch.
3.	Construct parallel lines	When he is able to construct parallel line to a given dimension within a tolerance of ± .010 of an inch with the use of a scale and dividers.
4.	Divide a line into any number of equal parts	When the trainee is able to divide a line into a given equal number of parts by construction with the use of dividers.
5.	Layout and complete a metal locating template	When the trainee is able to layout a locating template to the dimensions given on a print to a tolerance of ± .010 with the use of a scale, dividers and a scribe, with the line widths not to exceed .004.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 5 - Using Portable & Stationary Power Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Operate a floor mount drill press	When the trainee can define the safety precaution and procedures for installing drills, table adjustments, spindle adjustments, adjustment of drill speeds and lubrication.
2.	Operate a band saw	When the student is able to saw to a given line within .030 of an inch, and demonstrate the proper adjustment of the saw to given safety standards.
3.	Demonstrate the use of a disc sander	When the student is able to grind to a given line within .020 of an inch, and define all safety precautions in the use and setup of the equipment.
4.	Set up and operate a table saw	When he can demonstrate the ability to setup the blade high, fence, blade guard, hold downs, mitre guide and show the proper use of a push stick and all other safety standards.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 6 - Drill Reaming & Taping

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Apply blue dye	When the surface of the metal has received an even coat of bluing without runs in the area where the layout is required.
2.	Layout hole locations	When the hole locations have been located per the sketch to a tolerance of ± .010 with no scribe lines exceeding .004 in width.
3.	Center punch locations	When the cross hairs of the hole locations have been center punched within .010 of the center line with a depression deep enough to index the tip of the drill for drilling.
4.	Drill selection	When the size of the drills chosen leave sufficient material for a 60% thread and when the drill size for reamed holes allows .015 for reaming.
5.	Chuck drill in air motor	When the drill has been chucked in the air motor with a chuck key sufficiently to insure against turning in the chuck.
6.	Drill holes	When the hole locations have been drilled with the use of a hand air drill and a drill block to a tolerance of ± .010 and an angular tolerance 1/4 of one degree.
7.	Tap holes	When the required holes have been tapped with the use of a two flute tap to an angular tolerance of one degree with the proper lubricant used on the tap to insure against breakage.
8.	Reaming holes	When a pilot reamer of the proper size has been lubricated and the hole reamed up to size to allow an interference fit of plus .000 and minus .0005 to an angular tolerance of ± 1/4 of one degree.
9.	Steel stamp part number	When the project has been steel stamped with 1/8 letters and numbers per the identification on the sketch.
10.	Safety and housekeeping	When all safety precautions have been utilized in the manufacturing operations of the project and the work area and hand tools have been cleaned to their original condition.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 7 - Demonstrate the Cure and Use of Files

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Identifying the parts of a file	When the trainee is able to identify the tang, heel, body, edge, tip and cutting surfaces on all types of files.
2.	Demonstrate the use of a file	When the trainee can demonstrate the proper stroke, position, pressure, speed, and cleaning methods.
3.	Identifying the types of files	When the trainee can identify a straight, cross, draw, lathe and contour files and the purpose for each of the above.
4.	Safety	When the trainee can demonstrate the safety precautions for filing such as using an appropriate handle and avoids using a file for a hammer or as a pry.
5.	File to a given line	When the trainee can demonstrate the ability to file to the center of a given line, maintaining an edge 90° to the surface of the material to the required finish.
6.	House cleaning	When the shop area has been cleaned in accordance with the housekeeping standards and the cutting surface of the files have been cleaned with a pick and a file card to their original condition.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 8 - Fabricate a Plaster Splash Cast

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of pattern surface	When the surface of the pattern is free of all irregularities and a coat of Solvat A has been applied to the surface of the tool and allowed to dry at room temperature.
2.	Apply parting agent	When two coats of clear lacquer have been applied to the surface of the pattern without runs or excessive buildup and allowed to dry at room temperature. The entire surface of the tool must receive a coat of grease sparingly applied with a brush and all excess removed with a clean piece of cheesecloth.
3.	Mix Hydrocal	When the trainee is able to calculate the proper ratio of plaster to water and demonstrate the ability to mix a normal consistency batch without lumps.
4.	Apply Hydrocal face coat	When the trainee can apply a brush coat of hydrocal to the mold surface without entrapping air to a thickness of approximately 1/4 inch.
5.	Allow face coat to firm up	When the hydrocal has been allowed to firm up at room temperature to a state where the reinforcing material will not work through the gel-coat.
6.	Application of sisal and hydrocal batt reinforcement.	When sisal batts have been saturated in a normal consistency mix and applied to the gel-coat of the entire surface of the tool to a thickness of approximately one inch.
7.	Cure splash cast	When the splash cast has been allowed to cure at room temperature until all heat has dissipated and all surface moisture has evaporated.
8.	Attach reinforcement pipe	When pieces of normalized steel pipe have been attached to the back of the splash cast with hemp batts saturated in a normal consistency mix. Apply pipe ties as required to insure sufficient reinforcement.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 8 - Fabricate a Plaster Splash Cast

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
9.	Remove splash cast from mold	When the hemp reinforcement ties have cured and the complete periphery of the splash cast rough trimmed to insure parting. The splash cast must be removed without cracking or distorting the mold or splash.
10.	Establish reference lines	When all reference lines are rescribed leaving witness marks every six inches to a tolerance of ± .010 of an inch with the line not to exceed .004 of an inch in width.
11.	Clean up splash cast	When the splash cast has been roughed sawed to the desired size and all surface irregularities removed and all identification applied to the surface of the splash cast.
12.	Clean work area	When all hand tools, mold, and shop equipment utilized in the fabrication of the splash cast have been cleaned and restored in accordance with shop safety and housekeeping standards.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 9 - Laminate a Room Temperature Epoxy Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Clean the tooling aid and rework the surface if required	When the surface is clear from all foreign matter and all pits, gouges, and irregularities are eliminated.
2.	Apply parting agent to a plastic tooling aid	When the tool has received three coats of paste wax with sufficient drying time between coats.
3.	Determine the square footage of reinforcement material required for the laminant	When the trainee can calculate the square footage within one square foot.
4.	Calculate the amount of resin required, gel-coat, and laminating	When the weight of the laminating resin and hardener equal the weight of the cloth and when the gel-coat and hardener is 90 times the number of square feet in the laminant.
5.	Weigh resin and hardener	When the trainee is able to weigh the proper ratio of resin to hardener within a tolerance of one percent.
6.	Prepare coordination pins	When the pins have received an application of high vacuum grease and all excess grease is removed.
7.	Index the coordination pins	The trainee must install the pins prior to the application of gel-coat.
8.	Apply gel-coat	When 90 grams of resin is applied per square foot to approximately 1/32 of an inch in thickness with no air pockets or voids.
9.	Allow gel-coat to cure	When the resin is allowed to reach a tack free state.
10.	Cut glass reinforcing material	When the glass cloth is cut 90° to weave and all selvage edges are removed. Pieces shall not exceed 24 x 24 inch square.
11.	Apply the mixture of laminating resin and hardener	When the resin does not exceed 50 grams per square foot.
12.	Apply base layer of glass cloth	When the laminating resin is worked up through the layer of cloth and all wrinkles removed.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 9 - Laminate a Room Temperature Epoxy Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
13.	Continue application of glass cloth and resin	When step #12 is repeated until the desired thickness is reached. Every other layer must be rotated 45 degrees.
14.	Add dry peel ply	When 24 x 24 inch plys of 128 glass cloth are applied to the laminant with minimum amount of wetting.
15.	Allow laminant to cure	When the laminant has been allowed to cure 24 hours at room temperature.
16.	Remove peel ply	When the peel ply can be removed without breaking the laminant loose from the tooling aid.
17.	Cut reinforcing stiffeners	When the stiffener is cut to meet drawing requirement and the contour of the stiffener matches the laminate within 1/4 of one inch.
18.	Measure and mark stiffener location on laminant	When the stiffener locations do not interfere with the function of the tool.
19.	Mud in stiffeners	When a bead of putty mix is applied to the laminant and the stiffener set into the bead with sufficient putty to round the corners to a 1/2 inch minimum radius.
20.	Apply three layers of glass cloth and allow the tool to cure	When the glass cloth extends 1-1/2 inches beyond the 1/2 inch minimum radius without bridging or wrinkling.
21.	Pull coordination pins and remove laminant	When the laminant is removed from the tooling aid without damage to the laminant or aid.
22.	Rescribing existing reference line	When the line or layout is within .010 of the witness line and the scribe line does not exceed .004 in width.
23.	Saw rough trim	When the tool is trimmed within 1/16 of one inch outside the net trim.
24.	File net trim	When the edge is smooth and 90° to the surface of the tool within a tolerance of ± .010.
25.	Complete tool	When all voids and sharp edges are removed and the tool is painted and identified per drawing or standard.
26.	Clean tools, equipment, and work area	When the equipment and work area meet the housekeeping and safety standards of the shop.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 10 - Laminating and Reinforcing a Plastic Face Splash Cast

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of the mold	When the surface of the mold has been cleaned and all surface defects repaired, and two coats of buffed paste wax applied to the surface of the mold.
2.	Calculate the amount of gel-coat and laminating resin	When the trainee has defined the laminating surface to the closest square foot.
3.	Weigh gel-coat and hardener	When the proper ratio of gel-coat to hardener is determined and the amount of gel-coat equals 100 times the square footage of the laminating surface.
4.	Mix gel-coat and hardener	When the gel-coat and hardener have been sufficiently mixed without whipping in excess air and the bottom and sides of the container are thoroughly scraped to eliminate any uncatalysised areas in the gel-coat.
5.	Apply gel-coat	When the gel-coat has been brushed or squeegeed in one direction only to avoid trapping air to a thickness of approximately 1/32 or 100 grams per square foot.
6.	Allow gel-coat to cure	When the gel-coat has set at room temperature for approximately 45 minutes or until it reaches a tack-free stage.
7.	Cut glass reinforcing material	When the glass tooling fabric has been cut 90° to the weave and all selvage edges removed with no pieces larger than 24 x 24 inch squares with sufficient material for three wraps.
8.	Weigh laminating resin and hardener	When the proper ratio of laminating resin to hardener has been defined and the amount of resin equals 50 times the square footage of the laminating surface per ply.
9.	Mix laminating resin and hardener	When the laminating resin and hardener have been mixed for two to three minutes and the sides and bottom of container scraped to insure proper mix.
10.	Apply resin and cloth	When a light coat of the resin mixture has been brushed or squeegeed on the gel-coat and worked up through a layer of glass reinforcing material to eliminate entrapped air and excess resin.
11.	Complete laminate	When the two additional layers of glass reinforcement material have been applied in the same manner as above with an additional 50 grams per square foot applied to the upper surface of the last ply.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 10 - Laminating and Reinforcing a Plastic Face Splash Cast

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
12.	Apply dry sisal	When a thin layer of dry sisal has been thoroughly worked into the wet resin on the back of the laminate.
13.	Mix and apply hydrocal	When a normal consistency mix of hydrocal has been applied to the resin impregnated sisal and worked in well to insure against voids or entrapped air.
14.	Make hydrocal and sisal batts	When sisal batts saturated in hydrocal have been applied to the total laminating surface to a buildup of approximately one inch.
15.	Allow to cure	When the plastic face splash cast has been allowed to set at room temperature for 24 hours.
16.	Add pipe reinforcement if required	When straight pieces normalized of steel pipe have been applied to the back of the splash cast with sufficient ties to insure proper reinforcement.
17.	Rough trim and pull plastic face splash	When the periphery of the splash cast has been rough trimmed to insure proper parting and the splash cast has been removed from the mold without damage or distortion to the mold or the splash.
18.	Rescribe reference lines	When all reference lines have been rescribed to a tolerance of ± .010 and witness marks have been left every six inches and the width of the scribe lines does not exceed .004 of an inch.
19.	Clean up splash cast	When all surface defects or irregularities have been eliminated and the periphery of the tool trimmed to eliminate all sharp edges and undesired excess.
20.	Identify tooling aid	When all reference lines have been identified and the part number scribed on the surface of the tool or if desirable scribed on a plaster pad on the reinforced side of the tool.
21.	Clean tools and shop area	When all hand tools, shop equipment, and the work area meet shop housekeeping requirements.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 11 - Sloush and Sweep a Plaster Mandrel

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of mold	When the mold has been reworked to eliminate any surface irregularities and a light coat of grease applied with all excess grease removed to insure proper parting.
2.	Mix Plaster	When a normal consistency mix of plaster has been mixed to a creamy state without lumps.
3.	Pour plaster - first stage	When the surface of the mold is completely covered with a coat of plaster by rotation to an approximate thickness of 1/8 of an inch with all excess poured from the mold.
4.	Pour plaster - second stage	When the process for step #3 has been repeated until the plaster buildup reaches a thickness of approximately 1/4 of an inch.
5.	Remove mandrel from mold	When the mandrel has heated and cooled air pressure will be used to loosen the mandrel from the mold. NOTE: Air pressure must be regulated to insure against breaking the mandrel.
6.	Mandrel cleanup	When the entire exposed surface of the mandrel has been smoothed with pointing plaster to remove all surface irregularities.
7.	Identify mandrel	When the mandrel has been identified with a cado pen for part number, lot, and date of fabrication.
8.	Sweep molding techniques, preparation of mold	Same as Step #1 of sloush method.
9.	Mix plaster	Same as Step #2 of sloush method.
10.	Sweep plaster	When plaster has been applied to the surface of the mold and allowed to set until it reaches the period of plasticity and its sweeped with a template with 3/8 of one inch set back.
11.	Remove Mandrel from mold	Same as Step #5 of sloush method.
12.	Mandrel cleanup	Same as Step #6 of sloush method.
13.	Identify mandrel	Same as Step #7 of sloush method.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 12 - Reworking Plastic Tools

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Determine rework requirements	When the trainee can determine the rework requirements with the use of the tool drawing and rework order.
2.	Prepare tool for rework	When the edge of the tool to be reworked has been beveled at approximately a 30° angle for three inches beyond the rework area and all paint or other foreign material removed and the beveled surface cleaned with MEK.
3.	Apply parting agent to the mold	When the surface of the mold in the rework area has had sufficient parting agent applied to assure proper parting.
4.	Apply rework tool to mold	When the tool to be reworked has been indexed to a mold carrying the proper configuration and clamped down to insure proper coordination.
5.	Laminate reworked area	When layers of cloth impregnated with the proper resin mix have been staggered up the beveled area to the desired thickness with three final layers overlapping the entire rework area.
6.	Cure	When the rework area has been cured in accordance with curing procedure for the resin system used.
7.	Remove from mold and trim complete	When the tool has been removed from the mold and new trim lines established in relation to reference lines on the laminate and trimmed to drawing configuration within $\pm$ .010 of an inch.
8.	Paint and identify	When the rework area of the tool has been sanded and repainted in accordance with drawing requirements and the rework identified on the tool tag.
9.	Housekeeping	When the work area is cleaned to shop housekeeping and safety standards.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 13 - Reworking Plaster Mockups

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Remove damaged area	When the face coat of plaster has been chipped out in the damaged area by the use of a hammer and chisel to a minimum depth of 1/8 of an inch with the entire periphery of the rework area serrated.
2.	Moisten rework area	When shop clothes have been positioned in the rework area and thoroughly saturated with water until the scratch coat of plaster refuses to absorb additional water.
3.	Mix plaster	When the proper ratio of plaster to water has been mixed without lumps or grit.
4.	Fair plaster	When the normal consistency mix of plaster has been allowed to sit until it reaches the period of plasticity and faired with the use of a spline until it matches the existing contour of the mockup within ± .005 of an inch.
5.	Pointing plaster	When a thin pointing batch of plaster has been applied with the use of a spring steel sweep to eliminate pin holes and scratches.
6.	Preparation of the reworked area	When the newly faired area has received three coats of Salvat A and sufficient drying time allowed to apply two coats of clear parting lacquer.
7.	Housekeeping	When the work area and equipment used have been cleaned in compliance with shop safety and housekeeping standards.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 14 - Casting with Epoxy Resins

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Preparation of mold	When the trainee is able to identify and apply the proper type and amount of parting agent to the mold to insure proper parting of the casting.
2.	Location of the sprue and vent	When the trainee has located the sprue at the lowest point of the cavity and the vent at the highest point of the casting to eliminate entrapped air.
3.	Prepare core and boxing templates for casting	When the core has had a sufficient number of drive screws attached to insure a sound bond and the boxing templates have received a sufficient coat of parting agent to insure parting.
4.	Position core and boxing templates	When the trainee has placed the core in a position to where the clearance around the core is consistent and with the maximum clearance of 1/2 inch and the boxing templates secure to insure against leakage and hydraulic pressure.
5.	Calculate the amount of resin and hardener required	When the trainee is able to calculate the volume of the cavity to the closest one hundred grams.
6.	Weigh and mix resin	When the trainee is able to weigh the proper ratio of resin to hardener within 1/2 of one percent and mix the resin and hardener thoroughly without whipping in excess air to the mixture.
7.	Remove excess air from resin	When the trainee is able to define pot life of the resin and apply a complete vacuum to the resin to bleed out all excess air with the use of a bell jar.
8.	Pour the casting	When the resin is introduced into the sprue with care taken to avoid the entrapment of air and poured slowly until the resin appears in the riser vent.
9.	Remove the casting	When the vent and sprue have been sawed off after curing and the boxing templates removed and the casting part is removed from the mold with the use of regulated air pressure.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 15 - Maintain Safety and Housekeeping

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
	Comply with safety precaution rules	When the trainee has abided by the following rules: 1. Reports all injuries. 2. Wears eye protection at all times. 3. Wears safety shoes. 4. Reports unsafe conditions. 5. Learns where nearest fire extinguishers are located. 6. Does not attempt to carry heavy loads alone. 7. Lifts by bending the knees not the back. 8. Keeps sleeves rolled up around machinery. 9. Places oily rags in designated container. 10. Shuts off machines when leaving them. 11. Uses compressed air for authorized purposes only. 12. No horse play.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 16 - Visualizing Objects on Prints, Sketches and Orthographic Drawings

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Line identification	When the trainee is able to identify by name the ten basic types of lines used on an orthographic drawing.
2.	Drawing format	When the trainee is able to identify the six basic areas of a drawing and define the functions of each of these areas.
3.	Identify the basic types of drawings	When the trainee is able to define the functions of a detailed drawing, assembly drawing, installation drawing, and a tooling drawing.
4.	Identify drawing symbols	When the trainee is able to identify and define functions of the twenty drawing symbols most frequently used.
5.	Visualization of an object	When the trainee can draw the third view of an object when two views are given.
6.	Definition of reference planes	When the trainee can identify by name and function a datum plane, machine reference plane, water line, buttock line, and station line plane, and their functional relationships.
7.	Identify sectional views	When the trainee is able to define the means of rotation of a cutting plane and draw a sectional view to the proper perspective.

VOCATION: Plaster and plastic tooling Mechanic

TASK: No. 17 - Fabricating a High Temperature Vacuum Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
1.	Rework surface defects and irregularities on tool aid	When the gel-coat surface of the tool is completely free of pits, gouges, and irregularities prior to laminating.
2.	Clean the surface of the tool aid of all foreign matter	When the tooling aid is cleaned with a clean cloth dampened with acetone in compliance with safety standards.
3.	Apply parting agent	When three coats of CD Mold Release is applied to the surface of the tool. The first two coats must be buffed; the third not buffed.
4.	Calculate and weigh the required amount of gel-coat and hardener	When the calculated amount of gel-coat and hardener equals 70 times the square surface of the tool and the percentage of resin and hardener are within ± one-half of one percent.
5.	Mix resin and hardener	When care is taken to insure that all hardener has been thoroughly mixed into the resin without whipping in an excess amount of air.
6.	Apply gel-coat	When the gel-coat has been applied to the tooling aid at a thickness not exceeding 1/32 of an inch with no voids of air bubbles.
7.	Allow gel-coat to set up	When the gel-coat has set twelve hours at room temperature and it is tack free to the touch.
8.	Wipe the cured gel-coat with a clean cloth dampened with water	When the gel-coat has been moistened without leaving excess puddles of water on the surface of the tool.
9.	Cut glass reinforcing material	When glass cloth is cut in 24 x 24 inch square pieces 90° to the weave and all selvage edges removed.
10.	Calculate and weigh the required amount of laminating resin and hardener	When the amount of resin per ply is equal to the weight of cloth per ply and the resin and hardener is within one-half of one percent of the required ratio.
11.	Apply resin mix and first layer of glass reinforcement	When approximately 30 grams of laminating resin has been applied per square foot and worked up through the precut glass reinforcing material. Cloth should be worked until it is tight to the surface of the tool with no wrinkles or trapped air.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 17 - Fabricating a High Temperature Vacuum Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
12.	Apply three successive layers	When the additional layers have been applied in the same manner as step #1 with every other ply rotated 45° to the weave.
13.	Apply peel ply	When precut 24 x 24 inch pieces of 128 or equivalent glass fabric have been applied to the surface of the laminant with a one inch overlap.
14.	Apply periphery and strip bleeder to the laminant	When a four-ply bleeder strip extends around total periphery of the laminant and clears the laminant by approximately one inch. When strip bleeders allow sufficient bleeding of excess air and resin without bridging.
15.	Vacuum bag and sweep out excess resin and entrapped air	When all air is removed from the laminant and no resin-poor areas exist.
16.	Cure laminant	When the laminant has been allowed to set at room temparature for a minimum of 12 hours.
17.	Remove vacuum bag and peel-ply	When the peel-ply has been removed without loosening the laminant from the tooling aid and without damaging the plys of the first stage laminant.
18.	Laminate second stage	When steps #10 through #12 have been repeated in the same manner, the performance of step #18 will have been accomplished.
19.	Apply bleeders and vacuum bag	Same as step #14.
20.	Sweep laminant of excess air and resin	Same as step #15.
21.	Allow laminant to cure	Same as step #16.
22.	Remove vacuum bag and peel ply	Same as step #17.
23.	Apply one day layer of tooling cloth and vacuum bag	When the entire surface of the tool has received a peel-ply of 1500 tooling cloth and rebagged with high temperature film and a vacuum is drawn with a minimum of 20 inches of mercury.
24.	Oven cure tool	When the tool has been cured at 150° for one hour under 20 inches of mercury and allowed to cool at 100° F in the oven.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 17 - Fabricating a High Temperature Vacuum Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
25.	Allow tool to cool	When the tool has remained in the oven until the temperature has reached 100° and after the tool has reached 100° the oven door can be opened until the tool reaches room temperature.
26.	Cut reinforcing stiffeners	When the reinforcing stiffeners have been fabricated of the same material as the laminant and match the contour of the laminant within 1/4 of an inch.
27.	Mud stiffeners to laminant	When the entire bonding surface of the stiffener has contacted mudded surface and has a minimum fillet radius of 1/2 inch.
28.	Allow stiffener bond to cure	When the mudded area is allowed to cure for a minimum of three hours.
29.	Reinforce stiffener bond	When the stiffener and laminant have been reinforced with three layers of 6 inch glass tape applied over the bonded area with no wrinkles or bridging.
30.	Allow tool to cure	When the tool has been allowed to set at room temperature for a minimum of 12 hours.
31.	Oven cure tool complete	When the tool has been cured in an oven for one hour at 105° F; 2 hours at 250° F; and three hours at 350° F.
32.	Allow tool to cool	Same as step #25.
33.	Remove tool from tooling aid	When the tool and tooling aid have reached room temperature, the high temperature tool should be removed without damage or distortion to the laminant.
34.	Install vacuum inlets	When a vacuum inlet has been counterbored and mudded on each end of the tool and reinforced for strength with three layers of glass cloth.
35.	Rework surface defects if required	When the surface of the tool is completely smooth and free of all nicks, gouges, and high spots.
36.	Apply surface bleeders to the face of the tool	When the tool has been covered on the face side with 6 layers of bleeder cloth.

VOCATION: Plaster and Plastic Tooling Mechanic

TASK: No. 17 - Fabricating a High Temperature Vacuum Tool

NO.	STEPS IN PERFORMING THE TASK	SATISFACTORY PERFORMANCE
37.	Vacuum bag the face of the tool only	When high temperature vacuum tape has been applied and diaphragm bagged with a minimum of 25 inches of mercury gauge pressure.
38.	Apply sealing resin	When the resin and hardener are mixed to the proper ratio within 1/2 of one percent and thinned to a free dropping consistency to a four to one ratio with a reducer.
39.	Cure sealing resin	When the tool is allowed to cure for two hours at room temperature and two hours at a 140° F.
40.	Apply second coat of sealing resin	Same as step #38.
41.	Cure tool complete	Same as step #39.
42.	Check vacuum leakage rate	When the vacuum leakage rate meets the requirements of the production specification for which the tool was fabricated.
43.	Remove vacuum and clean tool face	When the tool has reached room temperature, the bagging material and sealing tape has been removed, and the tool has been wiped with a clean cloth dampened in acetone.
44.	Apply parting agent and cure	When the tool has received four coats of CD Mold Release on the face side of the tool and cured in the oven at 250° F for four hours.
45.	Clean up tool complete	When all sharp edges on the tool have been removed and all surface defects filled and sanded.
46.	Identify tool	When a steel tool tag has been attached identifying part number, date manufactured, production specification, and specifying that the tool has been prepared with Mold Release.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #4	When given a dimensional drawing, the trainee will demonstrate his lay-out ability by constructing a locating template to a tolerance of ± .010 of an inch, measured work project P&PTM-4.
Task #4	When given a six-inch scale and a scribe, the trainee will demonstrate his ability to scribe a line to a given tolerance with line widths not exceeding .004 of an inch in width, measured by shop exercise #1 -4.
Task #4	When given a six-inch scale, dividers, scribe and sheet metal, the trainee will demonstrate his ability to erect a perpendicular, bisect an angle, and divide a line into a given number of parts to tolerances specified on a drawing, measured by shop exercise #2 -4.
Task #5	When given a drill press in a shop area the trainee must demonstrate setup procedures with respect to spindle adjustment, feed and speeds, table adjustments and related safety requirements, measured by a demonstration to the instructor.
Task #5	When given a band saw with welding accessory, weld a saw blade together and install in machine so that the blade cuts through stock without breaking or snagging, measured by demonstration.
Task #5	When given a band saw in the shop area the trainee must demonstrate his ability to setup and operate a saw by adjusting the blade for correct height and speed and safely cutting a piece of stock to within .015 of a scribed layout line, measured by demonstration.
Task #5	When given a disc sander in the shop area the trainee must be able to set up the table at a given angle; adjust the gap between the table and the wheel; reverse the polarity to the desired side of the table; and define all safety precautions related to operating. Measured by demonstration.
Task #5	When given a table saw the trainee must be able to make the required adjustment to regulate blade height, fence adjustment, blade guard, mitre guide, and set up the saw to cut to a given dimension within ± 1/64 of an inch. Measured by shop demonstration.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #6	When given a combination square, a scribe and stock he must demonstrate the ability to square up a work edge on the stock and layout hole location to a given drawing to a tolerance of ± .010 with no scribe line exceeding .004 in width. Measured by work project P&PTM 6-1.
Task #6	When given a center punch and ball peen hammer the student must be able to center the hole location within .010 of center line with the punch marks deep enough to capture the point of the drill. Measured by work project P&PTM 6-1.
Task #6	When given a drill motor, chuck key, drill, drill block and layout, the trainee must demonstrate his ability by drilling all holes as specified on the drawing to within ± .010 of the layout and to an angular tolerance of ± 1/4 of one degree. Measured by work project P&PTM 6-1.
Task #6	When given a two-flute tap, lubricant and tap handle he must be able to tap the holes specified on the drawing maintaining angular tolerance without breaking the tap. Measured by work project P&PTM 6-1.
Task #6	When given a drill, reamer, chuck key, and steel stamps, he must demonstrate his skills by reaming the required holes to an interference fit of $^{+.0000}_{-.0005}$ and an angular tolerance of ± 1/4 of one degree, and steel stamp the identification as stated on the drawing.
Task #7	When given a family of files and a handle and stock, he must be able to select the appropriate file for each filing operation. Measured by demonstration.
Task #7	When he can demonstrate the proper stroke, position, pressure and speed, and file to the center of a scribe line maintaining an edge 90° to the surface of the material. Measured by work project P&PTM 6-1.
Task #7	When given a file, file card, and pick, the trainee must demonstrate the proper cleaning methods to remove chips from clogged teeth. Measured by demonstration.
Task #8	When given a mold and various parting agents, the trainee must demonstrate his knowledge of applying parting agents by selecting the appropriate one and applying the agent without runs or excessive build-up. Measured by work project P&PTM 8-1.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #8	The trainee must demonstrate his knowledge of mixing plaster by calculating the proper ratio of hydrocal to water and mix a batch without lumps or grain, with the proper parting agent applied to the bowl for cleanup. Measured by work project P&PTM 8-1.
Task #8	When the trainee can fabricate a splash cast with a void free face with hydrocal batt reinforcement to a thickness of approximately one inch. Measured by work project P&PTM 8-1.
Task #8	When given the cured splash cast, a scribe, and a scale, the trainee must demonstrate his ability to rescribe reference line to a tolerance of $\pm$ .010 with line width not exceeding .004. Measured by work project P&PTM 8-1.
Task #9	The student must demonstrate his ability to prepare the mold for layup by reworking any surface irregularities and applying parting agent to the mold and coordination pins. Measured by work project P&PTM 9-1.
Task #9	When given a resin chart, resin, and hardener, the trainee must demonstrate his knowledge of resin mixes by weighing out the proper ratio of resin to hardener to a tolerance of $\pm$ one percent. Measured by demonstration.
Task #9	When given gel-coat mix, glass cloth, and laminating resin mix, the trainee must demonstrate his knowledge of hand laminating by fabricating a tool with a void free gel-coat and maintain one to one ratio by weight of glass cloth to resin without void, wrinkles, or bridging. Measured by work project P&PTM 9-1.
Task #9	When given stiffener stock, scriber, scale, drawing, and band saw, the trainee must demonstrate the ability to fabricate stiffeners to drawing requirement. Measured by work project P&PTM 9-1.
Task #9	The trainee must be able to install the stiffener to the tool with the use of mudding resin, laminating resin, and glass cloth without voids, wrinkles, or bridging with a minimum corner radius of 1/2 inch. Measured by work project P&PTM 9-1.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #9	When given the cured laminate and the required hand tool, the trainee must trim the tool to drawing tolerance and identify the tool as specified on the tool drawing. Measured by work project P&PTM 9-1.
Task #10	When given a mold and paste wax, the student must demonstrate his ability to prepare the mold for layup by applying two coats of paste wax and buff to a high gloss finish. Measured by successful parting of the tool.
Task #10	When given resin, hardener, scale, and mold, the trainee must demonstrate his knowledge of laminating by calculating the amount of resin and hardener required and weighed out the proper ratio within one percent. Measured by demonstration.
Task #10	When given the proper resin mixture, mold, and a brush, the trainee must be able to apply the gel-coat without voids to a thickness of 1/32 of an inch. Measured by demonstration.
Task #10	When given resin mixture, glass cloth, hydrocal, and sisal, the student must demonstrate his ability to fabricate a plastic face splash cast by completing the laminant free of voids, with the proper ratio of resin to cloth and reinforce with hydrocal and sisal. Measured by project P&PTM 10-1.
Task #10	When given the steel pipe, sisal, and hydrocal, the trainee must demonstrate the ability to reinforce the splash cast by attaching the pipe with sisal saturated with hydrocal with sufficient tees to insure proper reinforcement. Measured by work project P&PTM 10-1.
Task #10	When given a band saw, hammer, wedges, scriber, and scale, the trainee will demonstrate his ability to complete the splash cast by rough trimming and pulling the tool and rescribing all reference within .010 of location with line widths not exceeding .004 in width. Measured by work project P&PTM 10-1.
Task #11	When given plaster, water, parting agent, and bowl, the trainee must be able to mix a normal consistency mix of plaster without lumps and identify the period of plasticity. Measured by demonstration.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #11	When given plaster, water, parting agent, bowl, and a mold, the trainee must demonstrate his ability to sloush a mandrel in two stages to a thickness of approximately 1/4 inch. Measured by work project P&PTM 11-1.
Task #11	When given a mold containing a sloushed mandrel, the trainee must demonstrate the ability to remove the mandrel without breakage with the use of air pressure. Measured by work project P&PTM 11-1.
Task #11	When given a mandrel, pointing plaster and spring steel sweep, the trainee must demonstrate his ability to complete the mandrel by filling and scraping all surface irregularities. Measured by work project P&PTM 11-1.
Task #11	When given plaster, water, parting agent, bowl, and sweeping template, the student will demonstrate his ability to sweep a mandrel by applying the plaster to the mold and sweep a coat of plaster 1/4 of an inch in thickness when the plaster reaches its point of plasticity. Measured by work project P&PTM 11-2.
Task #12	When given a plastic tool, work order and drawing, the trainee must demonstrate his knowledge by identifying the rework required. Measured by demonstration.
Task #12	When given a mold, plastic tool, resin mixture, parting agent, and glass cloth, the trainee will demonstrate his knowledge by laminating the beveled rework area in compliance with drawing requirement. Measured by work project P&PTM 12-1.
Task #12	When given the cured rework tool, a file, band saw, scriber, and scale, the trainee must be able to rescribe trim line to drawing tolerance and trim to within $\pm$ .010 of rescribe lines, maintaining an edge 90° to the surface of the tool. Measured by work project P&PTM 12-1.
Task #13	When given a plaster mockup, rework order, and drawing, he must define the rework required and state a procedure and tool requirements for accomplishing the work. Measured by demonstration.
Task #13	When given a hammer, chisel, and drawing, the trainee must demonstrate his ability by removing the face coat of plaster in the rework area to a depth of 1/8 of an inch without damage to the mockup structure. Measured by demonstration.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #13	When given a fairing tool, plaster, water, bowl, shop clothes, and parting agent, the trainee must demonstrate his ability to fair plaster by fairing the rework area to within .005 of drawing requirements. Measured by work project P&PTM 13-1.
Task #14	When given a mold, core, boxing templates, parting agent, vent tube and sprue, the trainee must demonstrate the ability to prepare the mold for casting by locaing the vent and sprue and securing the boxing templates to eliminate all leakage. Measured by work project P&PTM 14-1.
Task #14	When given the prepared mold, resin mixture, and bell jar, the trainee must demonstrate his ability to pour the casting by removing all excess air from the resin mixture and introduce it into the sprue in a manner which will avoid the entrapment of air. Measured by work project P&PTM 14-1.
Task #14	When given a mold containing a casting, the trainee must demonstrate the proper parting techniques by removing the casting with the use of air pressure without damage to the casting. Measured by work project P&PTM 14-1.
Task #15	When given a list of safety precautions, the trainee must define the proper procedure for complying to the rules by correctly answering 15 of 20 questions on exercise E-15.
Task #15	When given a manufacturing process, the trainee must define the housekeeping procedure required to maintain a clean and safe work area. Measured by oral discussion.
Task #16	When given any ten symbols used on blueprints, the student, without the aid of reference, will give the full word or words for each.
Task #16	When given a simple object, the student will demonstrate the ability to recognize each of the six standard views used in orthographic projection and indicate the three preferred views.
Task #16	When given three views of a simple object, the student will be able to shape modeling clay to the general configuration of the object. Measured by demonstration.
Task #16	When given a blueprint containing sectional views, the student will identify the sectional views by the appropriate sectional indicator. Measured by demonstration.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic
Plastic Bench Mechanic
Machine & Hand Parts Finisher

NUMBER	
Task #14	When given the 10 basic lines used on an orthographic drawing, the trainee must demonstrate his knowledge by identifying the lines by name and giving their function. Measured by demonstration.
Task #14	When given a family of drawings, the trainee must demonstrate his knowledge by tracing detail parts from a detail drawing through the installation drawing. Measured by demonstration.
Task #14	When the trainee is given two orthographic views of an object, the trainee must demonstrate his knowledge by constructing the third view. Measured by demonstration.
Task #14	When given an assembly, detail and installation drawing, the trainee will demonstrate his knowledge by defining the functional relationship of each by correctly answering 8 of 10 questions on PBM E-14.

COURSE OBJECTIVES

VOCATION: Plaster and Plastic Tooling Mechanic

NUMBER	
Task #16	When given a blueprint, the student must state the part location with respect to reference planes.
Task #16	The student must be able to name and describe (5) five reference planes and locate a point on a part with the use of these planes. Measured by demonstration.
Task #17	When given a cross section of a high temperature vacuum tool, the trainee must demonstrate his knowledge of high temp laminating by describing the basic fabrication concepts for void free vacuum tools. Measured by demonstration.
Task #17	When given a mold and tape measure, the trainee must demonstrate his ability to calculate the amount of gel-coat, laminating resin and glass reinforcing material to fabricate a high temp tool. Measured by work project P&PTM 17-1.
Task #17	When given a mold, parting agent, gel-coat, laminating resin, glass reinforcing material, bleeder strips, bagging film, and vacuum, the trainee will demonstrate his ability to fabricate high temp vacuum tool free of voids to the dimensional requirement specified on the drawing. Measured by work project P&PTM 17-1.